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(54) Method of imaging a photosensitive printing forme and apparatus therefor

(57) A method of imaging a photosensitive printing forme for offset printing, comprises imagewise exposing a coating sensitive to UV light, preferably applied to a cylinder, thus cross-linking the exposed areas, and unexposed being removed. After a printing run, the imaged areas may be completely removed by ablation using high intensity UV light and the cylinder being re-imaged by the above method.

There is also disclosed an apparatus for imaging such printing formes comprising an array of mirrors 10 which can be individually moved by piezoelectric elements 13 and a second array of mirrors 14 which can also be individually moved by piezoelectric elements 18 so that UV light 4 can produce individual dots at P on the forme, the dots being of the appropriate diameter using lenses 16. If a 4 x 4 mirror arrays are used, a sixteen dot pixel is produced on the forme which is then advanced for subsequent exposure.

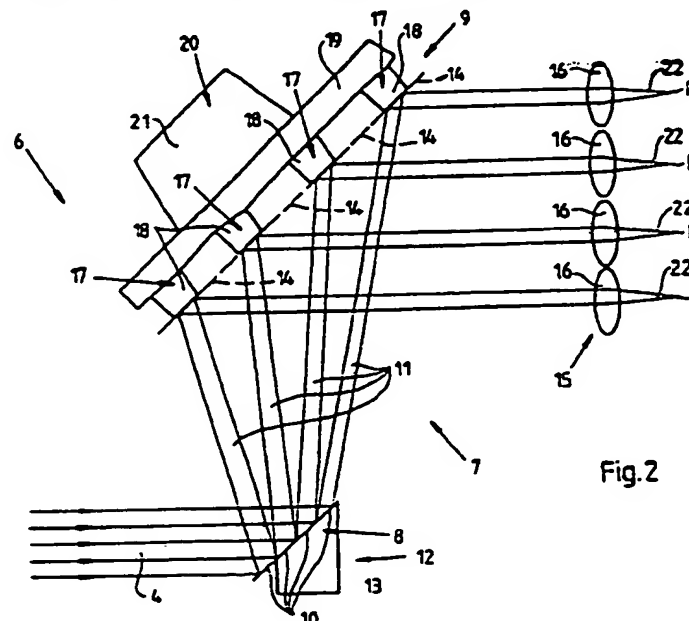


Fig. 2

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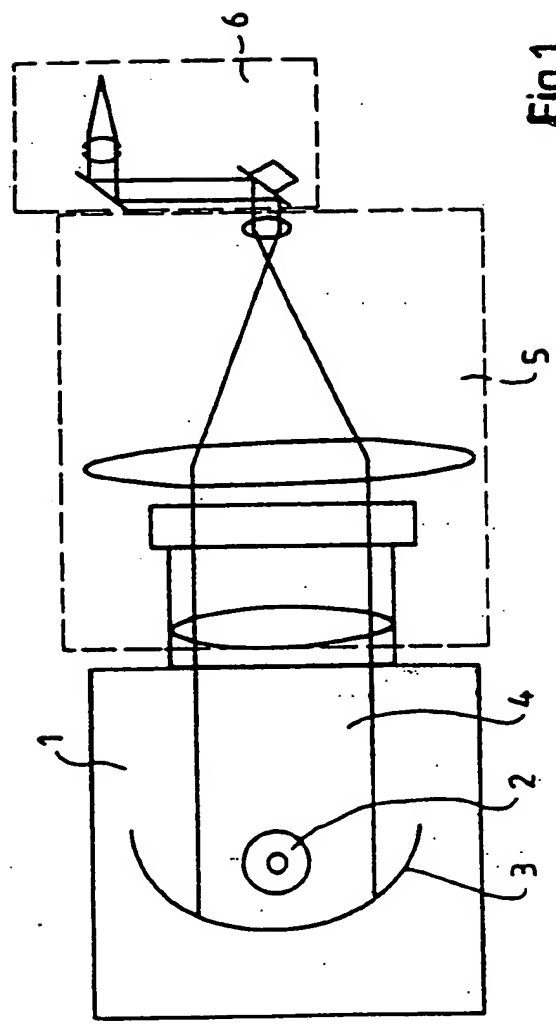


Fig.1

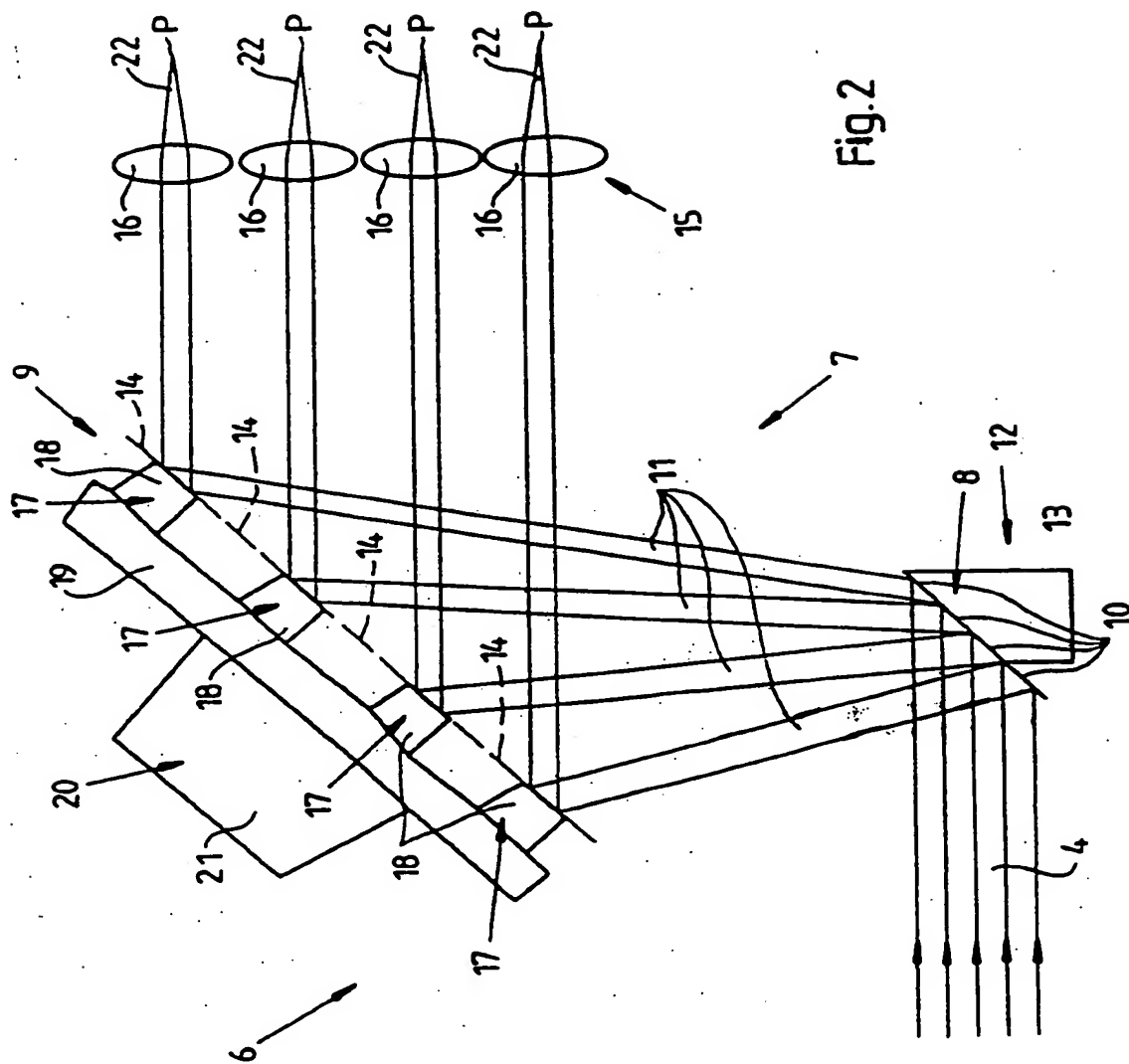


Fig. 2

METHOD OF RE-IMAGING A PRINTING FORME AND
APPARATUS FOR IMPLEMENTING SAID METHOD

The invention relates to a method of re-imaging a printing forme in offset printing.

It is known to use printing plates in offset printing. The printing plates preferably consist of aluminium; outside the printing machine said printing plates receive their respective motif in a relatively complicated process. In offset printing the printing plate is mounted on a plate cylinder of an offset printing machine. Upon completion of the print job the printing plate is removed from the offset printing machine, and either stored in an archive or destroyed. Alternatively, it is also possible to reprocess - for reuse - the removed aluminium-made printing plate outside the printing machine. However, very extensive efforts are required to reprocess printing plates. Moreover, these efforts have to be made outside the machine.

It is the object of the invention to provide a method of re-imaging a printing forme in offset printing, a method which is very simple and inexpensive to implement.

This object is achieved by applying a UV sensitive coating onto the printing forme, said coating being cross-linked in some areas by being imaged by means of UV light, areas which have not been imaged and thus not been cross-linked are removed. By doing so, the printing forme receives a respective motif in a very simple and repeatable manner. Only the areas of the coating, provided on the printing forme, which have been irradiated by UV light are cross-linked so that only said areas adhere to the printing forme. Said areas are hydrophobic i.e. water-repellent. The areas which have not been cross-linked due to lack of UV radiation can be easily removed from the surface of the printing forme, the uncoated surface of the printing forme being hydrophilic i.e. water-receptive. Consequently, dampening unit

and inking unit of an offset printing machine are in operation just like in conventional printing. That means that the coated cross-linked areas take on printing ink, whereas the uncoated areas are wetted by the dampening medium, the result thereof being a conventional offset printing process. A respective motif determines which areas of the coating sensitive to UV light are cross-linked; the printing forme is imaged i.e. irradiated by UV light according to the a respective motif desired. The coating sensitive to UV light is preferably applied onto an uncoated printing forme inside the printing machine.

According to a development of the invention the coating is applied onto a printing plate, especially an aluminium-made plate. Preferably a conventional offset printing plate may be used on which the motif is, however, not provided in the conventional manner; the coating sensitive to UV light is rather applied onto the printing plate. Upon completion of a print job the coating may be removed, and a new coating may be applied which may be used for a new print job after having been imaged by means of UV light. Again, upon completion of the print job the coating may be removed, and a new coating may be re-imaged. This process may be repeated until the printing plate has been worn out.

The peculiarity of this process consists in that both the application of the coating sensitive to UV light and the imaging by means of UV light take place inside the printing machine so that it is not necessary to change printing plates when changing print jobs.

Alternatively, it is also conceivable to apply the coating onto the surface of a cylinder of an offset printing machine. In this case, a cylinder of an offset printing machine is not provided with a printing plate but the surface of said cylinder rather bears the coating. Preferably the cylinder surface is designed so as to resist wear and tear and features hydrophilic

properties. According to a particular specimen embodiment the surface of such a cylinder may consist of a ceramic material.

In particular, the application of the coating, the imaging, and the removal of the areas not cross-linked and/or the cross-linked areas take place inside the offset printing machine. As has already been mentioned above, this facilitates the handling, as the mounting and the removal of printing plates can be dispensed with. Furthermore, the printing plate does not have to be adjusted because it is possible to generate a motif at the very appropriate location with simple means of optical imaging.

It is particularly advantageous to apply the coating sensitive to UV light by means of inking rollers of the inking unit of the offset printing machine. That means the inking rollers have a dual function in as far as, at first, at the beginning of a new print job they apply the coating sensitive to UV light, and secondly they supply the printing ink during the printing process. Preferably there is used printing ink sensitive to UV light, said printing ink forming the coating and providing the inking during the printing process.

After the imaging and the cross-linking the areas not cross-linked are preferably removed in a "clean run" by switching on the dampening-unit or the dampening/inking unit of the offset printing machine. In this case, the inking unit and/or the dampening unit of the offset printing machine operate(s) conventionally so that the areas which have not been irradiated and which have thus not been cross-linked, are ablated from the surface of the printing plate or the cylinder and thus removed. During a subsequent printing process the coated areas take on the printing ink supplied by the inking unit, whereas the uncoated areas which have been designed so as to be hydrophilic remain without any ink. Thus, it is possible to carry out offset printing in a conventional manner.

According to a development of the invention the cross-linked areas are removed by means of UV radiation of great intensity. If, upon completion of a print job, a new motif is to be generated, the printing forme is exposed to UV radiation of great intensity. The result of this high degree of intensity is that the cross-linked coating of the previously used motif is ablated from the plate surface and the cylinder surface, respectively (ablation). Thus, the printing forme is free of any coating and may be re-coated.

Preferably the applied coating may be an UV ink film or an UV varnish coating, the thickness of which advantageously amounts to 0.5 to 10 μm , especially 2 to 5 μm .

The cross-linking of the applied coating sensitive to UV light is preferably effected by means of, at least, one bundled UV light beam. In particular, the UV light beam causes the cross-linking, with the dot diameter being $<0.05\text{ mm}$, especially $<0.025\text{ mm}$. That means that the UV light beam may generate a dot screen, thus forming a motif.

Furthermore, the invention relates to apparatus for especially re-imaging a printing forme - provided with a coating sensitive to UV light - by means of UV light. For this purpose, a UV light source is used, the light of which is supplied to an arrangement having a plurality of individual mirrors with lenses for generating single beams each of which may be activated to generate a respective sharply delineated UV light dot by means of a respective actuator. Thus, an UV light dot may be generated by means of each individual mirror so that, depending on the number of individual mirrors used, a plurality of dots may be imaged simultaneously. In so doing, the imaging of the surface is rationalized. By means of the actuator assigned to each individual mirror it is possible to generate a sharply delineated UV light dot for the imaging process, or rather to

apply the UV light onto the coating in a scattered manner, which does not cause any cross-linking. In so doing, it is possible to pass the UV light over the coating without causing any cross-linking and thus not producing any printing areas. If a respective individual mirror is adjusted by means of an actuator, so that UV light is concentrated to form a sharply delineated UV light dot, the radiation causes a cross-linking at that point, thus producing a durable dot of the coating.

If the printing forme has been imaged over the entire circumference, the entire device is displaced by a respective imaging width so that the adjacent zone may be imaged as well. In this way the entire printing plate may be imaged zone by zone.

A preferred embodiment of the invention is now described with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic view of the entire arrangement for imaging the surface of a printing forme, and

Fig. 2 is a detail view of an imaging system for the UV light guidance of the device according to Fig. 1.

In order to produce a motif on a printing forme in offset printing, said printing forme is provided with a coating sensitive to UV light.

In the following specimen embodiment, the printing forme is designed as a printing plate mounted on a plate cylinder of an offset printing machine. An ink container is assigned to the inking unit of the offset printing machine. Said ink container contains printing ink which is sensitive to UV light. If this printing ink is applied onto the surface of the printing plate by means of the inking unit, a coating sensitive to UV light is

produced on said surface. The film of UV printing ink is applied on the entire surface of the printing plate. After having applied a film having a thickness of preferably 2 to 3 μ m, it is imaged by means of one or several tightly concentrated UV light beams i.e. the desired motif is produced by means of UV light. Said motif is formed of a screen, with the dot diameter being especially smaller than 0.025 mm. The individual dots are generated by means of the UV light beam, as the UV radiation causes the UV light-sensitive coating to be cross-linked on the surface of the printing plate. Upon completion of the motif the areas which have not been cross-linked by means of UV light are freed of the cross-linked areas in a clean run by switching on the inking/dampening unit of the offset printing machine. Consequently, a clean run during which the non-cross-linked areas are ablated takes place prior to the actual printing process.

As the coated areas feature hydrophobic properties, and the uncoated areas of the plate surface feature hydrophilic properties, the coated areas take on ink during the following printing process, whereas the uncoated remain free of ink. Thus, the offset printing process is performed in a conventional manner.

If, upon completion of the printing process, a new motif is to be produced, the entire surface of the printing plate is subjected to UV radiation of great intensity. This causes the cross-linked coating of the plate surface to be ablated (ablation). The result of the ablation process is an uncoated printing plate which again may be provided with a coating sensitive to UV light by means of the inking unit and be re-imaged by means of UV radiation.

Fig. 1 shows a device being used to image the coating sensitive to UV light. Said device has a UV light source 1 which, e.g., may be designed as an extra-high pressure mercury lamp (100 W Hg

extra-high pressure lamp; 100 W = power of 100 watts; Hg = mercury). A parabolic mirror 3 which in a concentrated manner supplies UV light 4 to a light-transmitting system 5 provided with lenses is assigned to said extra-high pressure mercury lamp 2. The UV light 4 provided by the light-transmitting system 5 is then supplied to the imaging system 6. Said imaging system 6 generates a plurality of controllable UV light dots which are used to generate a motif on a printing plate featuring a coating sensitive to UV light.

Fig. 2 explains the set-up of the imaging system 6 in detail. The UV light 4 supplied by the light-transmitting system 5 is directed to an arrangement of mirrors 7 having a mirror device 8 and a mirror device 9. Said mirror device 8 consists of several individual mirrors 10 the mirror surfaces being inclined towards each other at a certain angle so that a certain number of UV rays 11 is generated. The mirror device 8 preferably consists of sixteen individual mirrors 10 arranged, four by four, in a square of individual mirrors 10. The surfaces of the individual mirrors 10 are tilted with respect to each other by one degree. The individual mirrors 10 are provided on an actuator 12 designed as a piezoelectric crystal element 13.

The mirror device 9 also features individual mirrors 14, the number of said individual mirrors 14 corresponding to the number of the individual mirrors 10. The UV rays 11 obtained from the individual mirrors 10 are directed to the individual mirrors 14 where they are reflected and supplied to a system of lenses 15. According to the specimen embodiment described said system of lenses 15 features sixteen lenses 16 in total. Each individual mirror 14 is provided on an actuator 17 each of which is designed as a piezoelectric crystal element 18. All piezoelectric crystal elements 18 are supported on a base plate 19 which, in turn, is supported by an actuator 20 designed as a piezoelectric crystal element 21. The individual mirrors 10 are arranged such that the UV light supplied by the light-

transmitting system 5 is deflected transversely with respect to the direction of arrival. The thus formed individual UV rays 11 are, in turn, deflected by the individual mirrors 14 transversely with respect to the direction of incidence so that - bundled by the lenses 16 - UV light rays 22 having a respective dot diameter P of <0.025 mm are generated. In so doing, a printing plate having a coating which is sensitive to UV light may be imaged.

The actuators 12, 20 designed as piezoelectric crystal elements 13, 21 make it possible to correct the light guidance depending on the activation of the respective piezoelectric crystal element. The actuators 17, also designed as piezoelectric crystal elements 18, can be activated individually, thus influencing a sharply delineated light dot P of the UV light such that diffuse UV light (also not tightly bundled) is produced, which prevents the UV light-sensitive coating on the printing forme from being cross-linked. Consequently, it is possible - by individually activating the respective piezoelectric crystal element - to determine as to whether a cross-linked dot of the coating is to be produced at a certain point of the coated surface of the printing plate or not.

By means of the device illustrated in Fig. 2 a maximum of sixteen pixels can be produced on the surface of the printing plate by activating the respective piezoelectric crystal elements. Thereafter the plate cylinder is turned by another increment so that the subsequent area can be imaged and so on. After having imaged the entire circumference, the device is offset by an imaging width (track width) and the imaging is continued by correspondingly turning the plate cylinder step by step. The dot size of the cross-linked coating preferably has a diameter of <0.025 mm (which corresponds to $1000 \text{ dpi} = 40 \text{ dpmm}$). In particular, the dot size has a diameter of 0.01 mm (which corresponds to $2500 \text{ dpi} = 100 \text{ dpmm}$).

The inventive method makes it possible to image a printing plate sized 340 mm x 450 mm in approximately 150 seconds. This requires a cylinder diameter of 180 mm and a cylinder circumference of 565 mm. In circumferential direction the number of dots amounts to $565 \times 40 = 22,600$ dots and in axial direction to $340 \times 40 = 13,600$ dots.

Approximately 1 μs per dot is needed to cure UV ink (UV varnish).

It will of course be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

6. Method according to anyone of the preceding claims, characterized in that, by switching on dampening unit and/or inking unit of the offset printing machine, the non-cross-linked areas are removed in a clean run.
7. Method according to anyone of the preceding claims, characterized in that the printing is effected by inking the coated areas by means of printing ink, the printing ink being sensitive to UV light and forming a respective coating.
8. Method according to anyone of the preceding claims, characterized in that the cross-linked areas are removed by being exposed to UV radiation of great intensity.
9. Method according to anyone of the preceding claims, characterized in that an UV ink coating or an UV varnish coating may be used as a coating.
10. Method according to anyone of the preceding claims, characterized in that the coating applied has a thickness of 0.5 to 10 μm , especially 2 to 5 μm .
11. Method according anyone of the preceding claims, characterized in that the cross-linking is effected by means of, at least, one concentrated UV light beam.
12. Method according to Claim 11, characterized in

C L A I M S

1. Method of re-imaging a printing forme in offset printing, characterized by the application of a coating sensitive to UV light, respective areas of said coating being cross-linked by being imaged by means of UV light, and areas which have not been imaged and have thus not been cross-linked being removed subsequently.
2. Method according to Claim 1, characterized in that the coating is applied onto a printing plate, especially an aluminium-made plate.
3. Method according to anyone of the preceding claims, characterized in that the coating is applied onto the surface of a cylinder of an offset printing machine.
4. Method according to anyone of the preceding claims, characterized in that the application of the coating, the imaging, the cross-linking, the removal of the non-cross-linked areas and/or the removal of the cross-linked areas upon completion of a printing process take place inside the offset printing machine.
5. Method according to anyone of the preceding claims, characterized in that the coating sensitive to UV light is applied by means of inking rollers of an inking unit of the offset printing machine.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
 GB 9424292.2

Relevant Technical Fields

- (i) UK Cl (Ed.N) G2X (X2, XB21); B6C (CBAR)
 (ii) Int Cl (Ed.5) G03F and B41F

Search Examiner
 M K B REYNOLDS

Date of completion of Search
 15 FEBRUARY 1995

Databases (see below)

- (i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
 1-14

- (ii)

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Category	Identity of document and relevant passages		Relevant to claim(s)
X	EP 0559900 A	(NIPPON) Figures and examples	1-3, 9, 11 13
X	EP 0237574 A	(KITAMURA) Figures, page 34 and examples	1-4, 7, 9-10 13-14
X	EP 0197601 A	(STORK) Figures	1-3, 7, 9 11, 13-14
X	EP 0107065 A	(DUPONT) Figures and examples	1-3, 7, 9-10 13-14
X,P	US 5268259	(XEROX) Figure	1-3, 7, 9

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that the UV light beam causes cross-linking, the dot diameter being <0.05 mm, especially <0.025 mm.

13. Method according to any one of the preceding claims,
5 wherein the cross-linked coating has hydrophobic properties.

14. Method according to any one of the preceding claims,
wherein the uncoated surface of the printing plate or of the
cylinder of the offset printing machine has hydrophilic
10 properties.

15. Apparatus for re-imaging a printing forme provided
with a coating sensitive to UV light, comprising a UV light
source, the light of which is supplied to an arrangement of
15 mirrors having a plurality of individual mirrors for
generating single beams, each of which may be activated to
produce a respective sharply delineated UV light dot by
means of a respective actuator.

20 16. Apparatus according to claim 15, wherein an
activatable piezoelectric crystal element is assigned to
each individual mirror in order to be able selectively to
change the position of the respective mirror.

25 17. Apparatus according to claim 15 or 16, which can be
offset by an imaging width.

18. A method of re-imaging a printing forme in offset
printing, according to claim 1, and substantially as
30 hereinbefore described with reference to the accompanying
drawings.

19. Apparatus for re-imaging a printing forme,
substantially as hereinbefore described with reference to
35 the accompanying drawings.